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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,457	03/01/2004	Adam R. Pawloski	H1559	9956

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EXAMINER	
SULLIVAN, CALEEN O	
ART UNIT	**PAPER NUMBER**
1756	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/26/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/790,457	PAWLOSKI ET AL.	
	Examiner	Art Unit	
	Caleen O. Sullivan	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) *7 and 14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6, 8-13 and 15-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The Affidavit under 37 CFR 1.132 filed January 30, 2007 is sufficient to overcome the rejection of claims 1-6 and 10-13 based upon Rolland ('832).

2. The Affidavit under 37 CFR 1.132 filed January 30, 2007 is sufficient to overcome the rejection of claims 7-8 and 14-20 based upon Rolland ('832) in view of Costantini ('317).

Response to Arguments

3. Applicant's arguments, see page 8 of 9 **Rejection of Claims under 35 USC 102(e) and 103 over Rolland et al.**, filed January 30, 2007, with respect to the rejection(s) of claim(s) 1-6 and 10-13 under 35 USC 102(e) and with respect to the rejection(s) of claim(s) 7-8 and 14-20 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the prior art under 35 USC 103(a).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Switkes et al in view of Wallace ('801) and further in view of Costantini ('317).

Switkes et al describes a study on the feasibility of immersion lithography at 157nm, which is a limitation recited in claims 5 and 10 and is within the range recited in claim 4. (See, abstract). In this study a class of commercially available liquids such as perfluoropolyethers are identified as good candidates as an immersion lithography medium, which meets the limitation of claims 2, 11 and 17. (See, abstract). Switkes et al goes on to disclose that the perfluoropolyethers are a good immersion lithography medium because they are transparent, optically clean, chemically inert and compatible with some current resist materials, which meets the limitations of claims 3, 12, and 16 where the immersion lithography medium is non reactive with the material on the surface of the semiconductor wafer and is substantially transparent to radiation. (See, Section II. pg. 2353; 2355).

Switkes et al also describes performing an immersion lithography process. Thin layers of resist are spun on a Si substrate and then baked. The substrate was then covered with a thin layer of immersion fluid and then exposed. Next a low molecular weight solvent was used to remove the immersion liquid. After removing the wafer was subjected to a post exposure bake, followed by a developing step in a TMAH solution. (See, Section III. Pg. 2355). This disclosure meets the limitations of claims 1, 10 and 16 where an immersion lithography medium is applied to the surface of semiconductor wafer and the material on the surface of the wafer is exposed to electromagnetic radiation, as well as the limitation of claims 9 and 16 where the material layer on the wafer is exposed through the immersion lithography medium. This disclosure also meets the limitation of claims 6, 13 and 18.

Switkes et al fails to disclose a step of applying supercritical CO_2 to the wafer to remove the immersion lithography medium from the surface of the wafer; however, Wallace discloses such a process step.

Wallace ('801) claims a method of processing a wafer comprising the steps of: placing the wafer have a wafer surface in an enclosed and controlled environment; exposing said wafer surface to a cleaning medium rendered as a supercritical fluid; purging said environment of substance including soluble chemical compound liberated from said wafer surface by said cleaning medium. (See, claim 19). Wallace ('801) also discloses an example in which the supercritical fluid used is carbon dioxide. (See, col.8, 31-42). Wallace ('801) further discloses that removal of a material such as a fluorocarbon from the surface of a wafer could be facilitated by exposure to UV light during the exposure of the wafer to supercritical CO_2. These teachings in Wallace ('801) meet the limitation of claims 1, 10 and 16 where supercritical carbon dioxide is applied to a semiconductor wafer to remove immersion lithography medium from the surface of a semiconductor wafer.

Still Switkes et al in view of Wallace ('801) fails to disclose the limitations of claims 1, 10 and 16, where after supercritical CO_2 is applied to the surface of the wafer a mixture of immersion lithography medium and supercritical CO_2 is removed from the surface, and the limitation of claims 8, 15 and 19 where the immersion lithography medium is recovered by reducing the temperature or pressure of the mixture to remove CO_2 from the mixture. Switkes et al in view of Wallace ('801) also fails to disclose that the recovered immersion lithography medium will exhibit the same chemical composition or the same purity as the lithography medium applied to the surface of the wafer as recited in claims 20-21. Moreover, Switkes et al in view of Wallace ('801) fails to disclose that the immersion lithography medium recovered from the mixture is purified after the recovering. However, these limitations are taught in Costantini ('317).

Costantini ('317) discloses a supercritical fluid delivery and recovery system for semiconductor wafer processing. (See, col. 2, 7-11). In this method there is a recovery section (See, col. 3, 24-31) that takes in a solvent, which is a mixture of immersion fluid and supercritical CO_2, referred to as effluent, obtained from a semiconductor processing chamber. (See, col.6, 6-18). This disclosure teaches the limitations of claims 1, 10 and 16, where a mixture of the immersion lithography medium removed from the surface and the carbon dioxide is recovered. The recovery section functions to collect, separate and purify as recited in claim 22 the by-product gas, the co-solvent and other contaminants in the effluent and then return them to their respective receiver tanks or discharge as waste, which meets the limitation of claims 1, 10 and 16 where the immersion lithography medium that is recovered is recycled. (See, col.4, 1-10).

Costantini ('317) further discloses that in the recovery section the effluent passes into a separator where pressure and temperature fall below the critical points and the effluent separates into a vapor phase and a liquid phase. (See, col.6, 21-25). This disclosure teaches the limitations of claims 8, 15 and 19. The vapor phase contains the gas or gas mixture originally supplied into the feed portion of the system. The liquid phase contains the solvent and any other suspended components still remaining, and it is passed into a separator and heated to its boiling point. Then the solvent is separated as a vapor back to a suitable purity to be reused in the semiconductor wafer process chamber. (See, col. 6, 29-56). Although, Costantini ('317) does not specify a purity for the recovered immersion fluid, it is inherent that "suitable for re-use" means the recovered fluid would exhibit the same chemical composition or purity as the immersion fluid applied to the surface of the wafer as recited in claims 20-21.

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the teachings of Switkes et al in view of Wallace ('801) and further in view of

Costantini ('317), in order to recover the immersion lithography medium that is removed by applying supercritical CO_2 to the wafer, because Wallace teaches that supercritical fluids such as supercritical CO_2 can be use to remove substances such fluorocarbons from the surface a semiconductor wafer, and Costantini ('317) teaches that one can recover and the purify in order to recycle the immersion lithography medium that is recovered back to the semiconductor wafer processing chamber for re-use, resulting in a more economically efficient semiconductor wafer processing method.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caleen O. Sullivan whose telephone number is 571-272-6569. The examiner can normally be reached Monday-Friday, 8:30am-5:00pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

COS, 03-09-2007

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
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